

Simultaneous open fracture and rattlesnake bite on the same extremity


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ABSTRACT

Open fractures and rattlesnake envenomations are two emergencies that each require emergent intervention and treatment. While each is common, when they occur simultaneously on the same extremity, it creates a syndrome that is quintessential Central Texas. We present the case of a 13-year-old boy who sustained a lower-extremity rattlesnake envenomation with concomitant open tibia and fibula fractures after being thrown from an all-terrain vehicle. The envenomation from the snake bite compelled us to first treat his developing coagulopathy with a delayed operative management of his fractures.

KEYWORDS Envenomation; fractures; off-road motor vehicles; open; rattlesnake; snake bite

 Open fractures and snake bites are two entities that have been investigated and reviewed extensively, but which have not been previously described in the literature as occurring simultaneously. While the treatment for either insult can be difficult, the potential for complications exponentially rises when concomitant envenomation and open fractures occur in the same extremity.

CASE PRESENTATION

A 13-year-old otherwise healthy boy presented by ambulance 3 hours after an all-terrain vehicle accident. As the driver rounded a corner, the patient as the passenger was ejected, hitting a tree and landing on top of a rattlesnake. He had pain and swelling on his right lower leg and reported being bitten at this same site. Paramedics on the scene confirmed the presence of a rattlesnake. The patient's vital signs were within normal limits and remained stable. His right leg had an obvious deformity overlying the snake bite wounds (*Figure 1a–1c*). Compartments in the leg were tight but the patient had intact distal pulses and normal sensation. Plain films revealed acute, displaced, and overriding fractures of the proximal tibial and fibular shaft (*Figure 1d*). The patient had the following laboratory values: hemoglobin, 9.8 g/dL; platelet count, $134 \times 10^9/L$; international

normalized ratio, 2.8; D-dimer, 15.08 mcg/mL; fibrinogen, 119 mg/dL; creatine kinase, 369 IU/L; and normal creatinine.

While in the emergency department, the patient received six vials of antivenom (*Crotalidae* polyvalent immune fab) with a 1 L normal saline bolus, 1 g cefazolin, a tetanus booster, and fentanyl for pain. The compartment pressures in the right leg were normal. The wound was irrigated and left open without primary closure, and the leg was placed in a long leg splint without attempting reduction. The patient was admitted to the pediatric intensive care unit (ICU) for management of coagulopathy and for serial compartment checks of the right lower extremity.

In the ICU, the patient received another bolus dose of antivenom (six vials) and three subsequent maintenance doses (two vials each). Laboratory values showed continued improvement of his coagulopathy. He was taken to the operating room the following day for a washout and open reduction internal fixation with intramedullary nailing. One unit of red blood cells and fresh frozen plasma were given intraoperatively. He completed a 3-day course of intravenous antibiotics and was discharged on postoperative day 3. Several months later at follow-up appointments, the patient was doing well without any long-term sequelae.

DISCUSSION

This unique case highlights some key principles in the management of open fractures and snake envenomations.

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The authors report no conflicts of interest. Consent was obtained from the patient's guardian for publication of this case report.

Received March 26, 2021; Revised May 10, 2021; Accepted May 13, 2021.

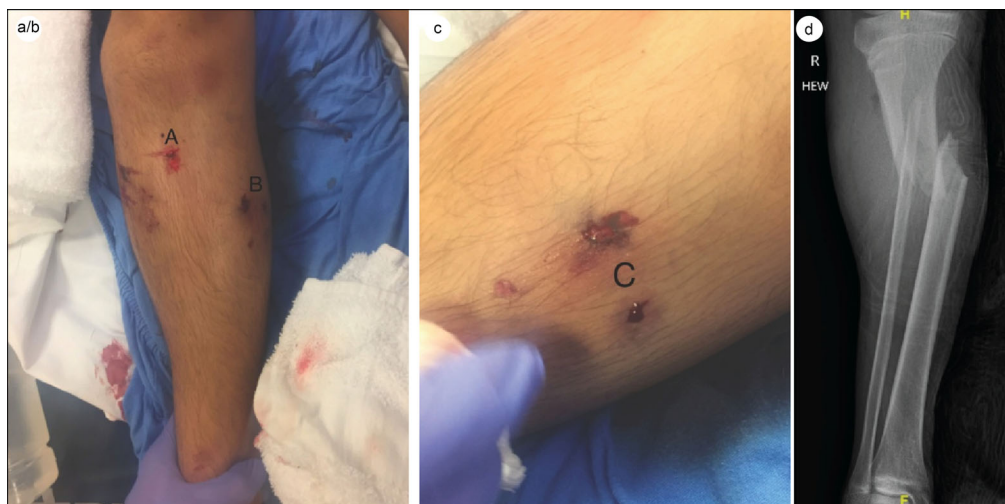


Figure 1. Left imaging showing (a) laceration overlying fracture and (b) fang marks from rattlesnake. (c) Detailed view of rattlesnake bite. (d) Radiograph showing fractures of tibial and fibular shafts.

Current guidelines regarding the management of open fractures vary based on the severity.^{1,2} For all open fractures, urgent antibiotics (typically a first-generation cephalosporin) and tetanus prophylaxis are given as soon as possible.^{3,4} The timing of surgical intervention, or whether to operate at all, is an ongoing debate; however, most recommendations suggest operative intervention with formal irrigation and debridement and internal fixation no later than 6 to 24 hours after the injury.⁵

Snake bite envenomations are less common than open fractures, but still affect a significant number of people in the United States, with estimates of up to 9000 people per year.⁶ The most common envenomations in the USA are from crotaline snakes, commonly known as pit vipers.⁷ These include rattlesnakes, copperheads, and water moccasins (cottonmouths). The presentation varies from asymptomatic dry bites to severe envenomations with vomiting, hypotension, altered mental status, myonecrosis, coagulopathy, and death. Labs should be drawn to evaluate for coagulopathy and tissue necrosis. Tetanus prophylaxis should be updated if necessary. Indications for antivenom include progression of pain and swelling, evidence of coagulopathy, or systemic manifestations such as unstable vital signs or altered mental status. All patients who receive antivenom should be admitted to the ICU. There is no need for prophylactic antibiotics in isolated snake bites, as infection is exceedingly rare (<1%).⁸

Several special considerations were made in this case with a combined open fracture and snake envenomation with lab work indicating coagulopathy. The wound was irrigated but left open. Antibiotics were administered for his open fractures and tetanus prophylaxis was given. Discussions were had relating to the optimal approach of fasciotomy in the setting of coagulopathy, which in this case, luckily, was never required.⁹ Stabilization of the extremity was performed with a splint but without attempted reduction, as this could have caused further tissue damage and hemorrhage in the setting of coagulopathy. The patient was given

antivenom and was admitted to the ICU, and surgery was delayed until the coagulopathy resolved.

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1. Elniel AR, Giannoudis PV. Open fractures of the lower extremity: current management and clinical outcomes. *EFORT Open Rev.* 2018; 3(5):316–325. doi:10.1302/2058-5241.3.170072.
2. Kim PH, Leopold SS. In brief: Gustilo-Anderson classification. *Clin Orthop Relat Res.* 2012;470(11):3270–3274. doi:10.1007/s11999-012-2376-6.
3. Whitehouse MR, McDaid C, Kelly MB, Moran CG, Costa ML. The effect of timing of antibiotic delivery on infection rates related to open limb fractures: a systematic review. *Emerg Med J.* 2017;34(9): 613–620. doi:10.1136/emmermed-2016-205900.
4. Zuelzer DA, Hayes CB, Hautala GS, et al. Early antibiotic administration is associated with a reduced infection risk when combined with primary wound closure in patients with open tibia fractures. *Clin Orthop Relat Res.* 2021;479(3):613–619. doi:10.1097/CORR.0000000000001507.
5. Godfrey J, Pace JL. Type I open fractures benefit from immediate antibiotic administration but not necessarily immediate surgery. *J Pediatr Orthop.* 2016;36(Supplement 1):S6–S10. doi:10.1097/BPO.0000000000000766.
6. Patel V, Hamilton RJ. Rattle snake toxicity. StatPearls [Internet]. Treasure Island, FL: StatPearls Publishing; 2020. <https://www.ncbi.nlm.nih.gov/books/NBK431065/>.
7. Ruha AM, Kleinschmidt KC, Greene S, et al. The epidemiology, clinical course, and management of snakebites in the North American Snakebite Registry. *J Med Toxicol.* 2017;13(4):309–320. doi:10.1007/s13181-017-0633-5.
8. August JA, Boesen KJ, Hurst NB, Shirazi FM, Klotz SA. Prophylactic antibiotics are not needed following rattlesnake bites. *Am J Med.* 2018;131(11):1367–1371. doi:10.1016/j.amjmed.2018.06.006.
9. Darracq MA, Cantrell FL, Klauk B, Thornton SL. A chance to cut is not always a chance to cure—fasciotomy in the treatment of rattlesnake envenomation: A retrospective poison center study. *Toxicol.* 2015;101:23–26. doi:10.1016/j.toxicol.2015.04.014.